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***Advanced Aerogel Technology***

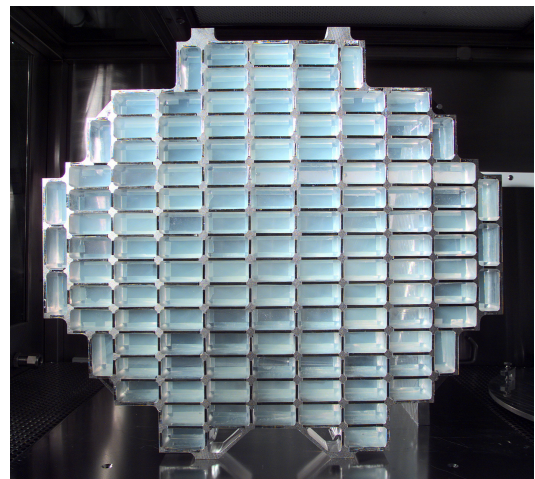
# Aerogel Technology at JPL

The JPL Aerogel Laboratory has made aerogels for NASA flight missions, e.g., Stardust, 2003 Mars Exploration Rovers and the 2011 Mars Science Laboratory, as well as NASA research projects for the past 14 years. During that time it has produced aerogels of a range of shapes, sizes, densities and compositions. Research is ongoing in the development of aerogels for future sample capture and return missions and for thermal insulation for both spacecraft and scientific instruments. For the past several years, the JPL Aerogel Laboratory has been developing, producing and testing a new composite material for use as the high temperature thermal insulation in the Advanced Sterling Radioisotope Generator (ASRG) being developed by Lockheed Martin and NASA. The composite is made up of a glass fiber felt, silica aerogel, titania powder, and silica powder. The oxide powders are included to reduce irradiative heat transport at elevated temperatures. These materials have thermal conductivity values that are the same as the best commercially produced high temperature insulation materials, and yet are 40% lighter.



By greatly reducing the amount of oxide powder in the composite, the density, and therefore for the value of the thermal conductivity, would be reduced. The JPL Aerogel Laboratory has experimented with using glass fiber felt, expanded glass fiber felt and loose fibers to add structural integrity to silica aerogels. However, this work has been directed toward high temperature applications. By conducting a brief investigation of the optimal combination of fiber reinforcement and aerogel density, a durable, extremely efficient thermal insulation material for ambient temperature applications would be produced.

If a transparent thermal insulation is desired, then aerogel is an excellent candidate material. At typical ambient temperatures, silica aerogel prevents the transport of heat via convection and conduction due to its highly porous nature. To prevent irradiative thermal transport, silica aerogel can be used in conjunction with a transparent polymeric material that blocks infrared radiation. The transparency of silica aerogel is typically greater than 90% for visible wavelengths from 500 nm to 900 nm for a 5 mm long path length.





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